

SECTION 7

DETAILED ANALYSIS OF ALTERNATIVES AND SELECTION OF PREFERRED ALTERNATIVE

7.1 INTRODUCTION

7.1.1 Six cleanup action alternatives were evaluated against the minimum threshold requirements of (i) protectiveness of human health and environment; (ii) compliance with the cleanup standards; (iii) compliance with the state and federal laws; and (iv) providing compliance monitoring. The cleanup action alternatives included No Further Action (NFA), Institutional Controls (ICs), surface clearance, clearance to frost depth, subsurface clearance, and excavation and restoration (E&R). This section presents the detailed analysis of these six cleanup action alternatives to identify the preferred cleanup action alternative for the various site types located within Camp Bonneville.

7.1.2 As discussed in Section 6, four cleanup alternatives (NFA, ICs, surface clearance and E&R) did not meet one or more of the minimum threshold requirements for all sites. The NFA alternative has been retained in this detailed analysis as the baseline alternative for comparative purposes only. The ICs alternative will meet the threshold requirements and therefore the ICs alternative has been retained for detailed analysis for those sites that pose only a minimal MEC exposure hazard. The ICs alternative may also be effective at those sites which pose an elevated explosive exposure hazard if implemented in conjunction with other clearance action alternatives. The surface clearance alternative was retained for those areas that may possess sensitive environmental or ecological resources that would be adversely impacted by another clearance alternative. The E&R alternative was retained in this detailed analysis as a permanent cleanup action alternative since MTCA requires the FS include one permanent cleanup action alternative. The clearance to frost depth and subsurface clearance alternatives were retained for this detailed analysis based on their compliance with minimum threshold requirements.

7.1.3 Due to the variability of MEC source types and the different risk associated with each, no single alternative, by itself, is appropriate for site-wide implementation. Alternative 2 (ICs), for example, may be appropriate for certain low risk areas of the site, but would not be sufficient in reducing the risk for areas of future intrusive activity. Therefore, an analysis and ranking of the six cleanup action alternatives is conducted for MEC source type areas and specific future reuse areas. This process allows each area of the site to be appropriately evaluated.

7.1.4 Based on this evaluation, a preferred cleanup action alternative will be selected for each of the site types to reduce explosive safety risk. Consistent with MTCA (WAC 173-340-360), the selected action shall: (i) use a permanent solution to the maximum

extent practicable; (ii) provide for a reasonable restoration time frame; and (iii) consider public concerns.

7.1.5 If a permanent cleanup action can not be implemented, MTCA requires that a disproportionate cost analysis be performed to evaluate whether the cleanup action uses permanent solutions to the maximum extent practicable. Although the E&R cleanup alternative is a permanent remedy, implementation of this cleanup action at Camp Bonneville, requires near-total ecological destruction, and as such, does not meet the minimum threshold requirements. The disproportionate cost analysis compares the costs and benefits of each of the six cleanup action alternatives. The cleanup action comparison will be performed consistent with the seven MTCA evaluation criteria, as presented in Section 7.2. Alternatives will be ranked from most permanent to least permanent based on the evaluation criteria. The ranking of alternatives for each of the site types is presented in Section 7.3. Section 7.4 describes whether the selected cleanup actions can be accomplished within a reasonable time frame.

7.2 EVALUATION CRITERIA

7.2.1 Cleanup action alternatives are compared and evaluated with the seven evaluation criteria as presented in WAC 173-340-360 for conducting a disproportionate cost analysis. The disproportionate cost analysis is performed by scoring each cleanup action alternative relative to the other alternatives for each of the seven evaluation criteria. Numerical values ranging from 0 to 10 were used for scoring the alternatives. A value of 0 represents the worst alternative and a value of 10 is the best alternative for satisfying the requirements of the respective evaluation criterion.

7.2.2 Upon completion of scoring the seven evaluation criteria for each alternative, the scores were summed to obtain the overall scoring for each cleanup action alternative. An alternative with the highest score was ranked as the most practicable permanent solution in reducing the MEC exposure hazard at the site. The following sections provide a description of each of the seven criteria and the ranking process used for performing the disproportionate cost analysis.

7.2.1 Protectiveness

7.2.1.1 The overall protectiveness to human health and the environment was evaluated based on the impact each cleanup action alternative has on the factors of MEC exposure hazard and environment. The human health protectiveness factor considers the impact that an alternative has on the MEC exposure hazard. As discussed in Section 4, the MEC exposure hazard is comprised of two components; the MEC source characteristics and the receptor interaction. Both of these two components are required in order to pose an explosive safety threat to the public. The environmental protectiveness factor considers the impact that implementation of a cleanup action alternative has on the existing environmental / ecological factors at Camp Bonneville.

7.2.1.2 The “Protectiveness” criterion was evaluated by scoring each cleanup action alternative relative to the other alternatives for MEC source and environmental protectiveness factors. For the MEC source factor, a cleanup action alternative was

scored highly if the alternative has the most impact on reducing the MEC source at the site. An alternative was scored least for the MEC source factor if the alternative has no impact on reducing the MEC source (i.e., Alternatives 1 and 2). Due to a greater overall reduction of risk, MEC source types with a high likelihood of munitions contamination (i.e., target areas and OB/OD areas), were scored higher than reduction of MEC source types with a low likelihood of ordnance contamination. Historically, UXO recovered from the site has been located within the upper 18-inches of the ground surface. Based on UXO recovered to date, most UXO would likely be removed by implementing Alternative 4 (frost depth clearance). Alternative 5 was often scored the same as Alternative 6 as there is little added MEC source risk reduction associated with the greater excavation depth of Alternative 6.

7.2.1.3 The environmental protectiveness factor was scored based on the detrimental impact an alternative will have on the existing environment and ecology at Camp Bonneville. Implementing a cleanup action alternative that has nominal detrimental effect on environment is scored as zero (i.e., Alternatives 1 and 2). An alternative which produces a large detrimental impact on the environment was assigned a score of –zero. Implementation of the E&R alternative will have a severe detrimental impact on the environment since it will result in near-total ecological destruction, and permanent loss in the viability of the local ecosystem. Therefore, the Alternative 6 was nearly always assigned a score of 0. Due to the removal of undergrowth required for DGM, Alternatives 4 and 5 were assigned variable scores dependent upon vegetation sensitivity and density.

7.2.2 Permanence

7.2.2.1 The “Permanence” criterion will evaluate the degree to which the cleanup action alternative permanently reduces or eliminates the explosive exposure hazard. Non-clearance cleanup alternatives (ICs and NFA) will have negligible impact in reducing MEC source and explosive exposure hazards; the MEC source risk will remain and, therefore, has little permanence. Alternative 3 (Surface Clearance) will score lower than intrusive MEC clearance alternatives (clearance to frost depth, subsurface clearance, and E&R) because of the possibility of residual subsurface UXO. Residual UXO within the upper 14-inch soil horizon has the possibility to present a future risk due to frost heave bringing the item to the surface. Alternative 4 (frost depth clearance) greatly reduces the possibility of UXO items being brought to the surface through frost heave mechanisms, but there is still a potential risk associated with future intrusive activities. Alternatives 5 and 6 were given high scores for the ability to remove all (or nearly all) possible UXO.

7.2.3 Cost

7.2.3.1 The “Cost” criterion evaluates the financial cost to implement the cleanup action alternative. The cost criterion includes direct, indirect, and long-term operation and maintenance costs. Direct costs are considered to be those costs associated with the implementation of the alternative. Indirect costs are those costs associated with administration, oversight and contingencies. Cost estimates presented are order-of-magnitude level estimates. These costs are based upon a variety of information including

productivity estimates (based on terrain and vegetation), cost estimating guides, and prior experience. The actual costs will depend upon true labor rates, actual site conditions (e.g., number of anomalies, terrain, etc.), final project scope and other variable factors. Detailed cost estimates associated with each alternative are included in Appendix C. Alternatives 1 through 6 were scored according to cost. The cost criterion was evaluated by assigning the highest numerical score for the alternative with the lowest cost to implement and the lowest numerical score for the alternative with the highest cost to implement. Alternative 1 was always scored highest (the NFA alternative does not have costs associated with it) and costs increased with each alternative.

7.2.4 Effectiveness over the Long-Term

7.2.4.1 The “Effectiveness over the Long-Term” criterion evaluates the degree of effectiveness in reducing the MEC risk once the cleanup action alternative has been implemented at the site, the magnitude of residual risk with the alternative in place, and the effectiveness of controls to manage the residual risk. An alternative was assigned with the lowest numerical score if it does not provide long-term effectiveness; while a high numerical score was assigned to the alternative that provides the best long-term effectiveness. Alternative 6 has the greatest “Effectiveness over the Long-Term” because there is no long term ICs associated with it and the site will have no restrictions on use (little or no residual risk). This benefit of reduction in risk, however, is only realized if the initial risk is great. ICs can be effective in managing residual risk as well and were scored accordingly for each area. Alternative 1 (No Further Action) scored lowest (0) at providing an alternative for managing risk.

7.2.5 Management of Short-Term Risks

7.2.5.1 The “Management of Short-Term Risks” criterion addresses the potential consequences and effects of an alternative during the implementation phase. Cleanup action alternatives were evaluated for their effects on human health and the environment prior to the cleanup action being completed. Short-term risks address adverse impacts to the workers and community during the construction and implementation phases of the cleanup action. Since a high score is favorable, this criterion was evaluated by assigning a high relative numerical score to an alternative that presents less short-term risks during the implementation phase. A low numerical score was provided to an alternative that presented greater short-term risks during the implementation phase. Alternative 6 predominantly scored zero (0) due to the much greater risk to workers conducting deep excavation (up to 10-feet) and sifting operations while using heavy equipment. Due to the inherent risk to UXO technicians, MEC clearance work (Alternatives 3 through 6) scored lower than non-clearance work (Alternatives 1 and 2). Intrusive work scored lower (greater risk) than non-intrusive work due to brush clearance requirements. In addition, scoring was adjusted for terrain hazards (greater risk, and thus a lower score, is associated with steep, rugged terrain). Intrusive work associated with the frost depth clearance (Alternative 4) can be completed using shovels, whereas greater depths associated with Alternative 5 (up to 4-foot depth) and Alternative 6 (10-foot depth) requires heavy equipment.

7.2.6 Technical and Administrative Implementability

7.2.6.1 The “Technical and Administrative Implementability” criterion evaluates the difficulty of implementing a specific cleanup action alternative. The evaluation included consideration of whether the alternative is technically possible; availability of necessary on-site and off-site facilities, services and materials; administrative and regulatory requirements; monitoring requirements; and access for construction operations. Alternatives were scored with low numerical values if it is technically and/or administratively difficult to implement at the site. Similarly, alternatives that are technically and/or administratively less difficult to implement were assigned with high numerical scores. Each successive alternative is more difficult to implement, and the alternatives were scored accordingly.

7.2.7 Consideration of Public Concerns

7.2.7.1 The “Consideration of Public Concerns” criterion based on the degree of assumed acceptance from the local public, including Clark County (representing the interests of the local community) and federal and state agencies regarding the implementation of cleanup action alternatives. Alternatives were scored with low numerical values if public acceptance was thought unlikely, and alternatives were scored numerically high if the public acceptance level is thought high.

7.2.8 Alternative Ranking by MEC Source Site Type

7.2.8.1 As noted in the Risk Assessment (Section 4), Camp Bonneville was divided into seven MEC source types, and were ranked according to relative explosive safety risk. The seven source types were ranked from highest to lowest risk as follows:

- Target Areas;
- Open Burn/Open Detonation Area;
- Firing Points;
- Range Safety Fans;
- Storage Magazines/Transfer Points;
- Maneuver Areas; and
- Training Areas.

7.2.8.2 In general, Target Areas, OB/OD Areas, and Firing Points were determined in the risk assessment to pose the greatest explosive safety exposure hazard; the remaining site types pose a negligible risk. The Target Areas, OB/OD Areas, and Firing Points are the primary focus of the detailed analysis of the cleanup action alternatives, based on MEC source types. [Tables 7.1, 7.2, 7.3, and 7.4](#) present the scoring and detailed analysis of the Target Areas, Central Impact Target Areas, OB/OD Areas, and Firing Points, respectively.

TABLE 7.1
ALTERNATIVE ANALYSIS AND SCORING TARGET AREAS

Target Sites	Acres	Explosive Risk Rank	Depth of Activity/Reuse
3.5-inch Rocket Range Target	5.2	Highest	Surface/Firing Range
Rifle Grenade Target	4.0	Highest	Surface/Firing Range
Hand Grenade (HE) Target	1.1	Highest	Surface/Firing Range
2.36-inch Rocket Target	0.3	Highest	None/Regional Park
M203 HE Grenade Target	4.0	Negligible ¹	None/Regional Park

(1) Removal Action completed to 2-feet and not included in the detailed analysis below. This area will be discussed in Section 8.

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	0 Concerns about risk and accessibility of 2.36" Rocket Target in Park.	40	6
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Limited reliability. Potential receptor interaction remains.	8 \$22,900	4 Limited effectiveness. Receptor awareness, but high MEC source risk remains	10 No risk increase to community or workers in short-term.	7 Signs and education material to be installed.	5 Concerns about risks associated with high MEC source areas within RP.	49	3
3) Surface Clearance	3 Limited source reduction. Surface reconnaissance previously conducted.	7 Limited impacts. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains.	7 \$130,500	5 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	6 Requires use of qualified/trained UXO personnel.	6 Concerns that MEC source remains subsurface and frost heave may cause near surface items to daylight.	46	4
4) Clearance to Frost Depth	8 Great reduction in MEC source. Based on historic data and weapons type, most UXO likely within upper 14"	5 Significant habitat destruction due to removal of brush/undergrowth. Not as critical for target areas that will be used as firing ranges.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	6 \$273,000	8 Effective at reducing risk given future reuse (firing ranges and non-intrusive, non-developed park area).	5 Risk to brush clearance, DGM, and UXO crews due to brush clearance equipment, terrain, and UXO.	5 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	10 Given the proposed reuse, there will likely be support for this alternative.	54	1

TABLE 7.1 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	9 Should eliminate nearly all risk from MEC source.	4 Similar to Alternative 4. Deeper excavations may have greater impact.	10 Reliable and likely eliminates MEC source.	5 \$382,000	8 Effective and targets areas available for almost any use. Little residual risk.	4 Similar to Alt. 4 with added risk due to heavy equipment for anomaly excavations.	4 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	8 Although protective, there is little added benefit over Alternative 4. Additional costs are unnecessary given intended reuse.	52	2
6) Excavation and Restoration	10 Should eliminate all risk from MEC source.	2 Complete habitat destruction for 2.36" target within RP. Not as critical for target areas that will be used as firing ranges.	10 Reliable and eliminates MEC source.	0 \$1,353,000	10 Effective and targets areas available for any use. Little residual risk.	2 Great risk to workers associated with deep excavations and sifting operations.	2 Most difficult alternative to implement due to logistics and heavy equipment required.	4 Likely seen as excessive and expensive given the intended reuse.	40	5

Note: Detailed cost estimates are included as Appendix C. Alternative 5 cost is an average of the 24-inch and 48-inch subsurface clearance.

TABLE 7.2
ALTERNATIVE ANALYSIS AND SCORING – CENTRAL IMPACT TARGET AREAS

Central Impact Target Sites	Acres	Explosive Risk Rank	Depth of Activity/Reuse
West Impact Target 2	8	Highest	None/None
Combined Impact Area 1	32	Highest	None/None
Combined Impact Area 2	43	Highest	None/None

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	4 Concerns about risk, but no intended reuse.	44	3
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Fencing and signage w/ land use controls. Potential receptor interaction remains.	8 \$124,500	4 Fencing is effective. Receptor awareness, but high MEC source risk remains	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed (fencing is in place). Land use controls require legal documentation.	5 Concerns about risks associated with high MEC source areas.	47	1
3) Surface Clearance	4 Limited source reduction. Surface reconnaissance previously conducted.	8 Limited impacts. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	4 \$1,344,000	6 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	5 Requires use of qualified/trained UXO personnel.	6 Concerns that MEC source remains subsurface.	45	2
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data and steep, rocky terrain in the target areas.	4 Significant habitat destruction due to removal of brush/undergrowth. Especially in a "natural" area.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$3,078,000	7 Effective at reducing risk given future reuse (non-intrusive).	4 Risk to brush clearance, DGM, and UXO crews due to brush clearance equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	5 Given the proposed reuse, concerns about habitat destruction and long term impacts associated with removal of all undergrowth. There will likely not be public support for this alternative.	41	5

TABLE 7.2 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	10 Should eliminate nearly all risk from MEC source, although little advantage over Alt. 4, given the intended reuse.	3 Similar to Alternative 4. Deeper excavations may have greater impact.	8 Reliable, likely eliminates MEC source, although little advantage over Alt. 4, given intended reuse.	2 \$4,288,000	8 Effective and targets areas available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	5 Similar to Alternative 4, with little additional benefit associated with Alternative 5 given the cost and intended reuse.	42	4
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	0 Steep terrain, dense vegetation. Complete habitat destruction in sensitive environment.	10 Reliable and eliminates MEC source.	0 \$10,899,000	10 Effective and targets areas available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse. Ecological destruction likely not tolerated.	30	6

Note: Detailed cost estimates are included as Appendix C. Alternative 5 cost is an average of the 24-inch and 48-inch subsurface clearance.

TABLE 7.3
ALTERNATIVE ANALYSIS AND SCORING – OPEN BURN/OPEN DEMOLITION AREAS

OB/OD Sites	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Demo Area 1	2.5	None ^{VI}	None/ Wildlife Mgt Area
Demo Area 2	2.0	Highest	Subsurface/Logging Area
Demo Area 3	2.0	Highest	None/Regional Park

(1) Demo Area 1 removed as part of 2004 removal action and not included in detailed analysis below. The kick-out areas associated with the OB/OD areas are discussed in Section 8.

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction. MEC source remains high.	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	0 Concerns about remaining risk.	40	6
2) Institutional Controls	0 No source reduction, remains high.	10 No Impacts to Environment	4 Limited reliability. Potential receptor interaction remains.	9 \$4,500	2 Limited effectiveness. Receptor awareness, but high MEC source risk remains. Subsurface activities proposed at Demo 2	10 No risk increase to community or workers in short-term.	7 Signs and education material to be installed.	2 Concerns about risks associated with high MEC source areas in an area of subsurface activities (i.e., logging camp) and Regional Park.	44	4
3) Surface Clearance	3 Limited source reduction. Surface reconnaissance previously conducted.	8 Limited impacts. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains.	7 \$ 47,000	5 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Accessible terrain.	6 Requires use of qualified/trained UXO personnel.	4 Concerns that MEC source remains subsurface.	45	3
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14"	6 Some habitat destruction due to removal of brush/undergrowth. Small areas - not as critical.	7 Reliable and eliminates risk of frost heave bringing UXO to surface. Not appropriate for subsurface activities.	5 \$ 95,000	6 Not effective at reducing risk given future intrusive reuse at Demo 2. Likely effective for Demo 3.	6 Risk to brush clearance, DGM, and UXO crews due to brush clearance equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	6 Given the proposed reuse, and high MEC source – approval unlikely for Demo Area 2. Possible approval for Demo 3.	47	2

TABLE 7.3 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	9 Should eliminate nearly all risk from MEC source.	5 Similar to Alternative 4. Deeper excavations may have greater impact.	10 Reliable and likely eliminates MEC source.	4 \$135,000	8 Effective and areas available for almost any use.	4 Similar to Alt. 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	10 Approval likely for intended reuse. Conservative approach for risk reduction.	53	1
6) Excavation and Restoration	10 Should eliminate all risk from MEC source.	2 Complete habitat destruction.	10 Reliable and eliminates MEC source.	0 \$513,000	10 Effective and areas available for any use.	2 Great risk to workers associated with deep excavations and sifting operations.	2 Most difficult alternative to implement due to logistics and heavy equipment required.	4 Likely seen as excessive and expensive given the intended reuse.	40	5

Note: Detailed cost estimates are included as Appendix C. Alternative 5 cost is an average of the 24-inch and 48-inch subsurface clearance.

TABLE 7.4
ALTERNATIVE ANALYSIS AND SCORING – FIRING POINT AREAS

Firing Point Sites	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Mortar Position 1	0.5	Medium	None/WMA
Mortar Position 2	0.5	Medium	None/WMA
Mortar Position 3	0.5	Medium	None/Regional Park
Mortar Position 4	0.5	Medium	None/Regional Park
Mortar Position 5	0.5	Medium	None/WMA
Mortar Position 6	0.5	Medium	None/Regional Park
Artillery Position 1	2	Medium	None/Regional Park
Artillery Position 2	2	Medium	None/Regional Park

Firing Point Sites	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Artillery Position 3	2	Medium	None/Regional Park
Artillery Position 4	2	Medium	None/Regional Park
Artillery Position 5	2	High	Surface/Trailhead Parking
Artillery Position 6	2	Medium	None/Regional Park
Artillery Position 7	2	Medium	None/Regional Park
Rifle Grenade Firing Pt.	1	High	Surface/Firing Range
3.5" Rocket Firing Pt.	1	High	Surface/Firing Range
M203 HE Grenade Pt.		Negligible ¹	None/Regional Park

(1) Removal Action completed to 2-feet and not included in the detailed analysis below. This area will be discussed in Section 8.

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source reduction, source remains medium.	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	0 Concerns about risk.	40	5
2) Institutional Controls	0 No source reduction.	10 No Impacts to Environment	4 Limited reliability. Potential receptor interaction remains.	8 \$33,000	4 Limited effectiveness. Receptor awareness, but MEC source risk remains. No subsurface activities proposed.	10 No risk increase to community or workers in short-term.	7 Signs and education material to be installed.	5 Concerns about risks associated with medium MEC source areas in the Regional Park, especially the 3 high reuse areas.	48	3
3) Surface Clearance	3 Limited source reduction. Surface reconnaissance previously conducted.	7 Limited impacts. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains.	7 \$ 211,000	5 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Accessible terrain.	6 Requires use of qualified/trained UXO personnel.	6 Concerns that MEC source remains subsurface.	46	4

TABLE 7.4 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
4) Clearance to Frost Depth	8 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data	6 Some habitat destruction due to removal of brush/undergrowth. Small areas - not as critical.	7 Reliable and eliminates risk of frost heave bringing UXO to surface. Not appropriate for subsurface activities.	5 \$ 421,000	7 Effective at reducing risk given no future intrusive reuse.	6 Risk to brush clearance, DGM, and UXO crews due to brush clearance equipment, terrain, and UXO.	5 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	9 No intrusive reuse proposed. Alternative should be considered adequate.	53	1
5) Subsurface Clearance	9 Should eliminate nearly all risk from MEC source.	5 Similar to Alternative 4. Deeper excavations may have greater impact.	10 Reliable and likely eliminates MEC source.	4 \$589,000	8 Effective and areas available for almost any use.	4 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	4 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	8 Little added benefit over Alternative 4. Additional costs not warranted for non-intrusive future reuse.	52	2
6) Excavation and Restoration	10 Should eliminate all risk from MEC source.	2 Complete habitat destruction.	10 Reliable and eliminates MEC source.	0 \$2,416,000	10 Effective and areas available for any use.	2 Great risk to workers associated with deep excavations and sifting operations.	2 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Likely seen as excessive and expensive given the intended reuse.	36	6

Note: Detailed cost estimates are included as Appendix C. Alternative 5 cost is an average for the 24-inch and 48-inch subsurface clearance.

7.2.8.3 Due to the unique characteristics associated with the Central Impact Area (the area surrounding the Central Impact Targets), this area is assessed and scored in [Table 7.5](#). The Storage Magazine/Transfer Point source type is a small area (2.0 acres) and although the relative risk is ranked “lowest”, the scoring and analysis for this MEC source type is included as [Table 7.6](#). The Range Fans and Maneuver Area source types are both quite large and reuse varies within each. The numerous and vastly different reuse scenarios associated with the Range Fans and Maneuver Area means that no single alternative (by itself) would be appropriate for the entire area. Therefore, the cleanup alternative analysis associated with the areas covered by the Range Fans and Maneuver Areas are addressed in the Reuse Area Assessment (Section 7.3). The last MEC Source Type area, Training Areas, includes the co-located M203 and Mortar Practice Range. As noted in the risk assessment, a removal action was completed in this area to a depth of 2-feet. Additional clearance is not anticipated for this area, and therefore, a detailed cleanup alternative analysis was not conducted. This training area, however, is discussed in more detail as part of the summary of recommended cleanup actions in Section 8.

TABLE 7.5
ALTERNATIVE ANALYSIS AND SCORING – CENTRAL IMPACT AREA (NOT INCLUDING TARGETS)

Site	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Central Impact Area (excluding targets)	382	Medium	None/None

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	4 Concerns about risk, but no intended reuse.	44	3
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Fencing and signage w/ land use controls. Potential receptor interaction remains.	8 \$573,000	4 Fencing is effective. Receptor awareness, but medium MEC source risk remains	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed (fencing is in place). Land use controls require legal documentation.	5 Concerns about risks associated with medium MEC source areas.	47	1
3) Surface Clearance	4 Limited source reduction. Surface reconnaissance previously conducted in most of the area.	8 Limited impacts. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$6,200,000	6 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	5 Requires use of qualified/trained UXO personnel.	6 Concerns that MEC source remains subsurface.	46	2

TABLE 7.5 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data and steep, rocky terrain.	4 Significant habitat destruction due to removal of brush/undergrowth. Especially in a "natural" area.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$14,200,000	7 Effective at reducing risk given future reuse (non-intrusive).	4 Risk to brush clearance, DGM, and UXO crews due to brush clearance equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	5 Given the proposed reuse, concerns about habitat destruction and long term impacts associated with removal of all undergrowth. Unlikely to be public support for this alternative.	41	4
5) Subsurface Clearance	8 Should eliminate nearly all risk from MEC source, although little advantage over Alt. 4, given the intended reuse.	3 Similar to Alternative 4. Deeper excavations may have greater impact.	8 Reliable and likely eliminates MEC source, although little advantage over Alt. 4, given intended reuse.	2 \$19,700,000	8 Effective and area available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	5 Similar to Alternative 4, with little additional benefit associated with Alternative 5 given the cost and intended reuse.	40	5
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	0 Steep terrain, dense vegetation. Complete habitat destruction in sensitive environment.	10 Reliable and eliminates MEC source.	0 \$50,200,000	10 Effective and area available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse. Ecological destruction likely not tolerated.	30	6

Note: Detailed cost estimates are included as Appendix C. Alternative 5 cost is an average for the 24-inch and 48-inch subsurface clearance.

**TABLE 7.6
ALTERNATIVE ANALYSIS AND SOCRING – STORAGE MAGAZINE/TRANSFER POINT**

Storage Magazines/Transfer Point Site	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Building 2950	2.0	Lowest	None/ Regional Park

Alternative	Protectiveness – MEC Source	Protectiveness – Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No impact on negligible MEC Source.	10 No impact to environment. Fenced area with buildings nearby.	0 No appreciable decrease to negligible exposure hazard	10 \$0	0 No appreciable decrease to negligible risk.	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	3 Concerns about location within Regional Park and historic use.	43	2
2) Institutional Controls	0 No impact on negligible MEC Source.	10 No impact to environment. Fenced area with buildings nearby.	0 No appreciable decrease to negligible exposure hazard	8 \$3,000	0 No appreciable decrease to negligible risk.	10 No risk increase to community or workers in short-term.	8 Signs and education material to be installed.	8 Likely support for effective education regarding and historic use.	44	1
3) Surface Clearance	0 No impact on negligible MEC Source.	10 No impact to environment. Fenced area with buildings nearby. No surface items.	0 No appreciable decrease to negligible exposure hazard	7 \$ 18,700	0 No appreciable decrease to negligible risk.	8 Little potential risk to UXO surface sweep technicians. Accessible terrain.	6 Requires use of qualified/trained UXO personnel.	6 Additional expense not warranted given the negligible MEC source.	37	4
4) Clearance to Frost Depth	0 No impact on negligible MEC Source.	10 No impact to environment. Fenced area with buildings nearby.	2 Little appreciable decrease to negligible exposure hazard	5 \$ 33,300	2 Little appreciable decrease to negligible risk.	7 Operational risk to DGM, and UXO crews. No excavations anticipated	5 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	5 Additional expense not warranted given the negligible MEC source.	36	5

TABLE 7.6 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	0 No impact on negligible MEC Source.	10 No impact to environment. Fenced area with buildings nearby.	3 Little appreciable decrease to negligible exposure hazard	4 \$47,500	3 Little appreciable decrease to negligible risk.	7 Operational risk to DGM, and UXO crews. No excavation anticipated.	5 Similar to Alternative 4. No heavy equipment for excavations.	5 Additional expense not warranted given the negligible MEC source.	37	3
6) Excavation and Restoration	0 No impact on negligible MEC Source.	0 Impact to area due to excavation.	3 Little appreciable decrease to negligible exposure hazard	0 \$250,000	3 Little appreciable decrease to negligible risk.	2 Great risk to workers associated with deep excavations and sifting operations.	2 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Likely seen as excessive and expensive given the intended reuse.	10	6

7.3 ALTERNATIVE RANKING BY FUTURE REUSE AREA

7.3.1 The proposed future land use for Camp Bonneville is recreational with varying levels of reuse intensity. The future land reuse intensity was based on the January 2003 Camp Bonneville Preliminary Site Plan. As noted in Section 4.4.13, the site has been geographically segregated based on proposed future land reuse areas. These land reuse areas include:

- Roads and Trails;
- Wildlife Management Area;
- High Intensity Reuse Areas;
- High Accessible – Medium Intensity Reuse Areas; and
- Medium Intensity Reuse Areas;

7.3.2 The site reuse areas and the associated detailed cleanup alternatives analysis includes: Roads and Trails ([Table 7.7](#)), Wildlife Management Area ([Table 7.8](#)), High Intensity Reuse Areas within the Regional Park ([Table 7.9](#)), High-Access Medium Reuse Areas within the Regional Park ([Table 7.10](#)), and the Remaining Medium Intensity Areas within the Regional Park ([Table 7.11](#)). Unlike the other reuse areas, the High Intensity Reuse Areas include areas with varying depths of future reuse activity. Due to the differences in the proposed depth of activity, the High Intensity Reuse Areas are separated into surficial (non-intrusive) and subsurface (intrusive) future reuse depths, and are analyzed separately.

TABLE 7.7
ALTERNATIVE ANALYSIS AND SCORING – ROADS AND TRAILS

Site	Miles	Explosive Risk Rank	Depth of Activity/Reuse
Roads and Trails	~45 ⁽¹⁾	Lowest – Highest ⁽²⁾	None/drive or hike

(1) Approximately 25 miles of trails are proposed in the Regional Park area and 20 miles in the Wildlife Management Area.

(2) The roads and trails travel across various MEC source type areas.

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	1 Concerns about high risk areas.	41	5
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Potential receptor interaction remains.	8 \$165,000	4 Receptor awareness, but MEC source risk remains	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed .	4 Concerns about risks associated with high MEC source areas.	46	3
3) Surface Clearance	2 Limited source reduction. Surface reconnaissance previously conducted.	9 Minimal impacts to existing roads/trails. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$1,180,000	6 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	5 Requires use of qualified/trained UXO personnel.	6 Concerns that MEC source remains subsurface.	45	4
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data.	8 Little habitat destruction on existing roads/trails.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$2,142,000	7 Effective at reducing risk given future reuse (non-intrusive).	5 Risk to DGM, and UXO crews due to equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	8 Given the proposed reuse, the alternative is appropriate.	49	1

TABLE 7.7 (Continued)

Alternative	Protectiveness - MECSource	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	8 Should eliminate nearly all risk from MEC source, although little advantage over Alt. 4, given the intended reuse.	8 Little habitat destruction on existing roads/trails.	8 Reliable and likely eliminates MEC source, although little advantage over Alt. 4, given intended reuse.	2 \$3,799,000	8 Effective and area available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations.	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	7 Similar to Alternative 4, with little additional benefit associated with Alternative 5 given the cost and intended reuse.	47	2
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	0 Steep terrain and complete destruction of roads/trails.	10 Reliable and eliminates MEC source.	0 \$13,748,000	10 Effective and area available for any use.	0 Great risk to workers associated with excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse.	30	6

NOTE: Detailed cost estimates are included in Appendix C. Alternative 5 cost is an average of 24-inch and 48-inch subsurface clearance.

TABLE 7.8
ALTERNATIVE ANALYSIS AND SCORING – WILDLIFE MANAGEMENT AREA

Site	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Wildlife Mgmt Area	~2,000 ¹	Lowest/Low ²	None/WMA

(1) Does not include Central Impact Area nor roads and trails within the WMA.

(2) WMA includes former Range Fan areas and Maneuver Areas.

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	4 Concerns about risk, but reuse is limited to wildlife management.	44	3
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Potential receptor interaction remains.	8 \$3,000,000	5 Receptor awareness, but low MEC source risk remains	10 No increase risk to community or workers in short-term.	6 Signs and education material to be installed.	7 Concerns about residual (albeit low) risk.	50	1
3) Surface Clearance	4 Limited source reduction.	8 Limited impacts. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$32,400,000	6 Limited effectiveness due to potential frost heave of shallow, buried UXO.	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	5 Requires use of qualified/trained UXO personnel.	6 Concerns that MEC source remains subsurface. Excessive cost.	46	2
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data	4 Significant habitat destruction due to removal of brush/undergrowth. Especially in a "natural" area.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$74,200,000	7 Effective at reducing risk given future reuse (non-intrusive).	4 Risk to brush clearance, DGM, and UXO crews due to brush clearance equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	5 Given the proposed reuse, concerns about habitat destruction and long term impacts associated with removal of all undergrowth. Unlikely public support.	41	5

TABLE 7.8 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	10 Should eliminate nearly all risk from MEC source, although little advantage over Alt. 4, given the intended reuse.	3 Similar to Alternative 4. Deeper excavations may have greater impact.	8 Reliable and likely eliminates MEC source, although little advantage over Alt. 4, given intended reuse.	2 \$103,500,000	8 Effective and area available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	5 Similar to Alternative 4, with little additional benefit associated with Alternative 5 given the cost and intended reuse.	42	4
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	0 Steep terrain, dense vegetation. Complete habitat destruction in sensitive environment.	10 Reliable and eliminates MEC source.	0 \$262,600,000	10 Effective and area available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse. Ecological destruction likely not tolerated.	30	6

NOTE: Detailed cost estimates are included in Appendix C. Alternative 5 cost is an average of 24-inch and 48-inch subsurface clearance.

TABLE 7.9
ALTERNATIVE ANALYSIS AND SCORING – HIGH INTENSITY REUSE AREAS WITHIN REGIONAL PARK

Site	Acres	Explosive Risk Rank	Depth of Activity/Reuse
High Intensity Reuse Areas (Non-intrusive)	160 ¹	Lowest/Low	Subsurface/Regional Park
High Intensity Reuse Areas (Intrusive)	50 ¹	Lowest/Low	Surface/Regional Park

(1) Primarily overlies Range fans and Maneuver areas. High use areas that overlie Firing Points and Target Areas were discussed previously.

ANALYSIS AND SCORING OF SUBSURFACE DEPTH OF ACTIVITY (INTRUSIVE)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	1 Concerns about intrusive activities and possible UXO.	41	4
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Potential receptor interaction remains.	8 \$75,00	2 Receptor awareness, but MEC source risk remains.	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed .	2 Concerns about risks associated with intrusive activities.	42	2
3) Surface Clearance	2 Limited source reduction. Surface reconnaissance previously conducted.	8 Minor impacts to park areas. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$639,000	2 Limited effectiveness due to intended intrusive reuse.	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	5 Requires use of qualified/trained UXO personnel.	3 Concerns that MEC source remains subsurface.	37	6
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data	7 Significant habitat destruction due to removal of undergrowth, but likely acceptable given reuse plans.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$1,502,000	4 Not effective at reducing risk given future reuse (intrusive).	5 Risk to DGM, and UXO crews due to equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	4 Given the proposed intrusive reuse, the alternative is not appropriate.	41	3

TABLE 7.9 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	10 Should eliminate nearly all risk from MEC source.	7 Significant habitat destruction due to removal of undergrowth, but likely acceptable given reuse plans.	8 Reliable and likely eliminates MEC source.	2 \$2,048,000	8 Effective and area available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	9 Likely acceptable as a conservative approach in light of MEC source and intended reuse.	50	1
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	7 Significant habitat destruction due to removal of all vegetation, but likely acceptable given reuse plans.	10 Reliable and eliminates MEC source.	0 \$6,565,000	10 Effective and area available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse.	37	5

ANALYSIS AND SCORING OF SURFICIAL DEPTH OF ACTIVITY (NON-INTRUSIVE)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	1 Concerns about MEC source.	41	4
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	4 Potential receptor interaction remains.	8 \$240,000	2 Receptor awareness, but MEC source risk remains.	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed .	2 Concerns about risks associated with intrusive activities.	42	2
3) Surface Clearance	2 Limited source reduction. Surface reconnaissance previously conducted.	8 Minor impacts to park areas. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$2,044,000	4 Limited effectiveness due to possible frost heave..	7 Potential risk to UXO surface sweep technicians. Difficult terrain.	5 Requires use of qualified/trained UXO personnel.	3 Concerns that MEC source remains subsurface.	39	5

TABLE 7.9 (Continued)

ANALYSIS AND SCORING OF SURFICIAL DEPTH OF ACTIVITY (NON-INTRUSIVE) (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
4) Clearance to Frost Depth	7 Great reduction in MEC source. Most UXO likely within upper 14" based on historic data	7 Significant habitat destruction due to removal of undergrowth, but likely acceptable given reuse plans.	7 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$4,805,000	7 Effective at reducing risk given future reuse (non-intrusive).	5 Risk to DGM, and UXO crews due to equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	9 Given the proposed non- intrusive reuse, the alternative is appropriate.	49	1
5) Subsurface Clearance	8 Should eliminate risk from MEC source, but little benefit over Alternative 4.	7 Significant habitat destruction due to removal of undergrowth, but likely acceptable given reuse plans.	8 Reliable and likely eliminates MEC source.	2 \$6,554,000	8 Effective and area available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	8 Likely acceptable, however, additional costs are unwarranted given the future reuse (non-intrusive).	47	2
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	7 Significant habitat destruction due to removal of all vegetation, but likely acceptable given reuse plans.	10 Reliable and eliminates MEC source.	0 \$21,009,000	10 Effective and area available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended non-intrusive reuse.	37	6

TABLE 7.10
ALTERNATIVE ANALYSIS AND SCORING – HIGH-ACCESS MEDIUM INTENSITY REUSE AREAS WITHIN REGIONAL PARK

Site	Acres	Explosive Risk Rank	Depth of Activity/Reuse
High-access Medium Reuse Areas	~180 ¹	Lowest/Low	Surficial/Regional Park

(1) Areas within the Regional Park that have gentle topographic slope (<15%) and low vegetative cover along Lacamas Creek valley floor area.

Alternative	Protectiveness – MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	1 Concerns about number of receptors given historic use.	41	5
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	3 Potential receptor interaction remains.	8 \$270,000	2 Receptor awareness, but MEC source risk remains.	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed .	6 Concerns about risks to receptors given historic use of the site.	45	3
3) Surface Clearance	0 No source reduction. Surface reconnaissance previously conducted.	8 Minor impacts to park areas. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$1,930,000	4 Limited effectiveness due to frost heave.	7 Potential risk to UXO surface sweep technicians.	5 Requires use of qualified/trained UXO personnel.	7 Concerns that MEC source remains subsurface.	41	4
4) Clearance to Frost Depth	8 Reduction in MEC source. Most UXO likely within upper 14” based on historic data	4 Significant habitat destruction due to removal of undergrowth.	8 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$4,643,000	7 Effective at reducing risk given future reuse (non-intrusive).	5 Risk to DGM, and UXO crews due to equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	9 Given the proposed non-intrusive reuse, the alternative is appropriate.	48	1
5) Subsurface Clearance	10 Should eliminate nearly all risk from MEC source.	4 Significant habitat destruction due to removal of undergrowth.	8 Reliable and likely eliminates MEC source.	2 \$6,217,000	8 Effective and area available for intended reuse.	4 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	8 Although protective, additional expense is unnecessary given the intended reuse.	47	2

TABLE 7.10 (Continued)

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
6) Excavation and Restoration	10 Should eliminate all risk from MEC source, although little benefit over Alternative 5.	0 Significant habitat destruction due to removal of all vegetation.	10 Reliable and eliminates MEC source.	0 \$23,635,000	10 Effective and area available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse.	30	6

TABLE 7.11
ALTERNATIVE ANALYSIS AND SCORING – REMAINING MEDIUM REUSE AREAS WITHIN REGIONAL PARK

Site	Acres	Explosive Risk Rank	Depth of Activity/Reuse
Remaining Medium Reuse Areas	~770 ¹	Lowest/Low	Surficial/Regional Park

(1) Primarily overlies Range fans and Maneuver areas. Medium reuse areas that overlie Firing Points and Target Areas were discussed previously.

Alternative	Protectiveness - MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
1) No Further Action	0 No source Reduction	10 No Impacts to Environment	0 No reliability	10 \$0	0 Risk remains (and may increase if receptors increase)	10 No risk increase to community or workers in short-term.	10 Readily implemented. No action required.	2 Concerns about receptors hiking through the area on short cuts, given historic use.	42	4
2) Institutional Controls	0 No source Reduction	10 No Impacts to Environment	3 Potential receptor interaction remains.	8 \$1,155,000	4 Receptor awareness, but MEC source risk remains.	10 No risk increase to community or workers in short-term.	6 Signs and education material to be installed.	5 Surface reconnaissance previously conducted. ICs should educate potential users. Low MEC source remains.	46	1
3) Surface Clearance	1 No source reduction. Surface reconnaissance previously conducted.	8 Minor impacts to park areas. Some brush clearance may be required.	5 Reliable method for surface UXO. Subsurface risk remains	5 \$11,152,000	2 Limited effectiveness due to frost heave.	7 Potential risk to UXO surface sweep technicians.	5 Requires use of qualified/trained UXO personnel.	5 Concerns that MEC source remains subsurface.	38	5
4) Clearance to Frost Depth	7 Reduction in MEC source. Most UXO likely within upper 14" based on historic data	4 Significant habitat destruction due to removal of undergrowth.	8 Reliable and eliminates risk of frost heave bringing UXO to surface.	3 \$25,841,000	7 Effective at reducing risk given future reuse (non-intrusive).	5 Risk to DGM, and UXO crews due to equipment, terrain, and UXO.	4 Requires use of qualified/trained UXO personnel and geophysicists with specialized (but readily available) equipment.	7 Concern over ecological damage. Significant cost given the intended reuse.	45	2

TABLE 7.11 (Continued)

Alternative	Protectiveness – MEC Source	Protectiveness - Environmental	Permanence	Cost	Long-term Effectiveness	Short-term Effectiveness	Implementability	Public Concerns	Score	Rank
5) Subsurface Clearance	7 Should eliminate nearly all risk from MEC source, but not more protective than Alternative 4 given the reuse.	4 Significant habitat destruction due to removal of undergrowth.	8 Reliable and likely eliminates MEC source.	2 \$35,660,000	8 Effective and area available for intended reuse.	3 Similar to Alternative 4 with added risk due to heavy equipment for anomaly excavations	3 Similar to Alternative 4 with added heavy equipment for anomaly excavations.	7 Concern over ecological damage.	42	3
6) Excavation and Restoration	7 Should eliminate all risk from MEC source, although little benefit over Alternative 4.	0 Significant habitat destruction due to removal of all vegetation.	10 Reliable and eliminates MEC source.	0 \$101,106,000	10 Effective and area available for any use.	0 Great risk to workers associated with deep excavations and sifting operations.	0 Most difficult alternative to implement due to logistics and heavy equipment required.	0 Excessive and expensive given the intended reuse.	27	6

7.4 REASONABLE RESTORATION TIME FRAME

7.4.1 In addition to the minimum threshold requirements, another requirement of MTCA [WAC 173-340-360(b)(ii)], is that the selected cleanup action shall provide for a reasonable restoration time frame. The most practicable permanent cleanup action alternatives identified in Sections 7.2 and 7.3 involve MEC clearance to frost depth, subsurface clearance, and institutional controls. It is estimated that a MEC clearance will take approximately 6 months to 1 year to complete at each site. Design and implementation of both site-wide and site-specific ICs can be completed in approximately 6 – 9 months. There are no other practical alternatives to MEC cleanup that would result in a shorter restoration time frame. The Camp Bonneville property should not be open to the public until the completion of the cleanup actions due to the residual explosive exposure hazard at a number of areas. Access to the site is currently restricted by a fence and gate and should be restricted until completion of the cleanup actions.